

Modelling growth in craniosynostoses: from cephalometrics to geometric approaches

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Craniosynostosis affects 1/2000 births and its incidence has increased by 12.5% between 1997 and 2013. Without surgery, craniosynostosis leads to neurological issues due to restrained brain growth and social stigma due to aesthetically deformed head shapes. Understanding growth patterns is essential to improve pre-operative surgery planning and assess long-term post-operative results. Here we provide an extensive review of the models of normal and pathological growth of the cranial vault. Descriptive models relying on actual skull geometries at different ages while comprehensive models mimic growth on standard cranial vaults. Results showed that successful models combine a macroscopic analysis of the cranial vault shape and a microscopic analysis of the sutural development. Models tend to correctly portray normal growth but have difficulties generalizing the method to all types of craniosynostosis. Furthermore, the role of the brain and the timing of growth are limited in the models. Growth modelling is central when assessing craniofacial architecture in young patients, and Delaire's approach is strongly linked with the principles underlying the most advanced current approaches.